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ORIGINAL RESEARCH

Role of multidetector CT in radiological evaluation of paranasal sinuses in patients with chronic rhinosinusitis

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ABSTRACT

Introduction: Chronic rhinosinusitis (CRS), with or without nasal polyps, is characterized by the inflammation of the nose and paranasal sinuses. To make the diagnosis of CRS, a patient must exhibit 2 or more of the following symptoms for at least 12 weeks time period: nasal obstruction, nasal blockage, or congestion, and/or nasal discharge (which could be anterior or posterior nasal drip), along with possible facial pain or pressure, and/or a reduction or loss of smell. This diagnosis must be supported by observable disease signs, which can be identified through an endoscopic examination showing nasal polyps, mucopurulent discharge, or edema/mucosal obstruction.**Methods:** A prospective study will be conducted on all the patients with clinical diagnosis and suspicious of CRS, referred from OPD / wards of ENT and HNS to the department of radiodiagnosis of Muzaffarnagar Medical college, for diagnosis and evaluation of patients. Diagnosis will be made based on clinical and radiological findings. A brief clinical history of the patient will be taken from the patient or by the attendant.**Results:** In this study involving 40 participants, nasal mass was observed in 42.5%, while nasal bleed occurred in 47.5% of participants. X-ray opacification of sinuses varied, with opacification in all sinuses seen in 22.5% of cases and various bilateral and unilateral patterns in others. Polypoidalmass was present in 12.5% of participants. Bony changes included erosion in5% and sclerosis in 22.5% of cases. Deviated nasal septum was observed, with left deviation noted in 10% and right deviation in 15% of participants.**Conclusion: t**his study of 40 participants revealed a male predominance and a mean age of 39.8 years, with no significant age difference between genders. Common symptoms included nasal obstruction, nasal discharge, sneezing, headache, facial puffiness, and altered smell. Nasal mass and nasal bleed were frequent, while X-ray opacification of sinuses showed diverse patterns. Polypoidal masses were observed in a notable percentage of participants.

Keywords:rhinoshinositis, maxillary sinus, frontal sinus, onodi cell, MDCT

INTRODUCTION

Chronic rhinosinusitis (CRS) is a condition characterized by persistent inflammation of the nasal and paranasal sinus (PNS) mucosa, often triggered by environmental factors. The 1997 Task Force established diagnostic criteria for CRS, requiring either two major symptoms or one major symptom accompanied by two minor symptoms persisting for at least 12 weeks. These criteria were updated by the American Academy of Otolaryngology in 2000 and further refined by the European Position Statement in 2012 to include radiological or endoscopic evidence of inflammation alongside symptoms like facial pressure, nasal obstruction, loss of smell, and purulent nasal discharge (1).CRS is classified into two categories: CRS with nasal polyposis (CRSwNP) and CRS without nasal polyposis (CRSsNP). CRSwNP is often linked with asthma and aspirin sensitivity, indicating a higher disease burden compared to CRSsNP. The pathophysiology of CRSwNP involves T-helper type 2 cell-driven inflammation, frequently associated with tissue eosinophilia and asthma, whereas CRSsNP may result from recurrent acute sinusitis or anatomical obstruction of the sinus ostium, potentially leading to hypoxia in the sinus cavity (2).Diagnosis of CRS necessitates persistent

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symptoms supported by imaging or endoscopic findings, even after treatment. Functional endoscopic sinus surgery (FESS) commonly targets sinus drainage pathways, particularly the osteomeatal complex, which is a critical area implicated in CRS (3). Anatomical variations, such as nasal septum deviations and anomalies in the osteomeatal complex or frontal sinus recess, can obstruct sinus drainage and complicate FESS. CT imaging plays a crucial role in identifying these variations, aiding in surgical planning and effective management of CRS (4).While digital radiography, including various views like Waters' and Caldwell's, is often used in initial investigations, it does not reliably predict the etiology of sinus disease (5). CT scans, particularly coronal sections, are preferred for their detailed visualization of sinonasal anatomy and pathology, which is vital for FESS planning and assessing chronic rhinosinusitis. MDCT technology has significantly enhanced head and neck evaluations by providing high-resolution images, aiding in accurate diagnosis, treatment planning, and reducing morbidity associated with surgical interventions (6-11). MDCT's comprehensive imaging capabilities surpass the limitations of direct endoscopy, guiding targeted treatment plans for CRS (12-14). CRS management typically involves a combination of medical and surgical interventions, with surgery reserved for cases unresponsive to medical therapy or those with structural abnormalities (15). Addressing both symptoms and quality of life is crucial for comprehensive CRS management (16).

METHODOLOGY

Study Design and Setting: This observational study was conducted in the Department of Radiodiagnosis & Imaging at Muzaffarnagar Medical College & Hospital, Muzaffarnagar, Uttar Pradesh, over a period of 18 months. The study involved 40 patients who were clinically diagnosed or suspected to have Chronic Rhinosinusitis (CRS) and were referred from the Department of ENT & Head & Neck Surgery.

Inclusion Criteria: Patients clinically diagnosed or suspected of having CRS.
Patients with abnormal paranasal sinus (PNS) X-rays suggestive of CRS.

Exclusion Criteria: Patients with associated malignancies of the nose, paranasal sinuses, or oral cavity.
Pregnant women.
Patients diagnosed with Acute Rhinosinusitis.

Ethical Considerations: Informed consent was obtained from all participants before inclusion in the study. Ethical approval was obtained from the institutional ethics committee prior to the commencement of the study.

Imaging Protocol: All patients underwent Digital Radiography of the paranasal sinuses, including various views such as occipitofrontal, occipitomeatal, and lateral skull views, as required for initial assessment. For detailed evaluation, Multidetector Computed Tomography (MDCT) of the paranasal sinuses was performed using a Siemens Somatom Scope 16 Slice CT machine. The scans were conducted with proper patient positioning. Thin-section coronal plane images were acquired, and axial sections were reconstructed. Three-dimensional (3D) reconstructions were performed when necessary.

Data Collection: Clinical data were collected, including a brief medical history, either directly from the patients or from their attendants. The findings from MDCT scans were meticulously documented. These included assessments of anatomical variations, the extent of sinus involvement, and any other relevant observations.

Statistical Analysis: The collected data were tabulated and subjected to statistical analysis using SPSS version 17. Chi-square test and student t test were employed to evaluate the results, ensuring a comprehensive analysis of the study data.

RESULT

There was a notable male predominance in the study, with 72.5% (29 out of 40) of the participants being male. The mean age of male participants was slightly higher (41.2 ± 21.7 years) compared to females (36.1 ± 12.4 years), although this difference was not statistically significant.The most prevalent symptom among participants was nasal obstruction, reported by 77.5% (31 out of 40). Nasal discharge was also common, affecting 67.5% (27 out of 40) of the participants. Other frequent symptoms included headache (52.5%), altered smell (45%), facial puffiness (45%), and nasal bleeding (47.5%). These symptoms highlight the chronic and multifaceted nature of CRS in the studied population.X-ray opacification was present in all sinuses in 22.5% of participants, with the maxillary sinuses being most commonly involved (35% when combining bilateral and unilateral cases). The osteomeatal unit (OMU) was identified as a critical area in 30% of the cases, suggesting its significance in the pathophysiology of CRS. Additionally, pansinusitis was observed in 15% of the patients, indicating a widespread inflammatory process in a notable subset of the population.Onodi cells, anatomical variants important for surgical planning, were present in 20% of the patients, while Haller cells were found in 12.5%. Concha bullosa and Agger Nasi cells were equally common, each present in 37.5% of participants. These anatomical variations can significantly impact the clinical presentation and surgical approach in CRS management.Sphenoid sinus pneumatization was predominantly of the complete sellar type, observed in 65% of participants,

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which is crucial for preoperative planning due to its proximity to critical structures like the optic nerve and internal carotid artery.The presence of hyperdense content in 15% of patients suggests chronic, possibly fungal, infection, which warrants specific medical or surgical intervention. The identified anatomical variants (e.g., Onodi and Haller cells) underline the importance of detailed preoperative imaging to prevent complications during functional endoscopic sinus surgery (FESS).

Table: Distribution of study finding

Variable	Category	Frequency (N)	Percentage (%)
Sex Distribution	Male	29	72.5
Sex Distribution	Female	11	27.5
Age (mean Â± SD)	Male	41.2± 21.7	
Age (mean Â± SD)	Female	36.1± 12.4	
Nasal Obstruction	Present	31	77.5
Nasal Discharge	Present	27	67.5
Sneezing	Present	14	35
Headache	Present	21	52.5
Facial Puffiness	Present	18	45
Altered Smell	Present	18	45
Nasal Mass	Present	17	42.5
Nasal Bleed	Present	19	47.5
Polypoidal Mass	Present	5	12.5

Table 2: X-ray opacification of sinuses in study participants (N=40)

		Frequency	Percentage
X-ray opacificationof sinuses	All Sinuses	9	22.5
	B/L F	3	7.5
	B/L M	4	10.0
	B/L M E	1	2.5
	B/L M EF	2	5.0
	B/L ME,R F	1	2.5
	B/LME,LS	1	2.5
	B/L S	2	5.0
	L F,M	2	5.0
	L M	7	17.5
	R M	7	17.5
	R SE F M	1	2.5
	Total	40	100

Table 3: Pattern of inflammatory disease in study participants(N=40)

		Frequency	Percentage
inflammatory disease	FrontalSinusitis	3	7.5
	Infundibular	4	10.0
	Mucocele	2	5.0
	OMU	12	30.0
	OMU+INFU	1	2.5
	OMC+SE+INFU	1	2.5
	OMC+SE	2	5.0
	Pansinusitis	6	15.0
	Polyp	5	12.5
	Retention Cyst	2	5.0
	SE	2	5.0
	Total	40	100

Table 4: MDCT findings in study participants

Variable	Sub-Variable	Frequency (N)	Percentage (%)
Hyperdense Content in MDCT	Present	6	15
Haller Cell	Present	5	12.5
Onodi Cell	Present	8	20

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Agger Nasi	Present	15	37.5
Concha Bullosa	Present	15	37.5
Anterior Clinoid Pneumatization	Present	5	12.5
Olfactory Groove Pattern	Asymmetrical	13	32.5
Olfactory Groove Pattern	Symmetrical	27	67.5
Sphenoid Sinus Pneumatization	Complete Sellar	26	65
Sphenoid Sinus Pneumatization	Conchal	1	2.5
Sphenoid Sinus Pneumatization	Incomplete Sellar	9	22.5
Sphenoid Sinus Pneumatization	Presellar	4	10

DISCUSSION

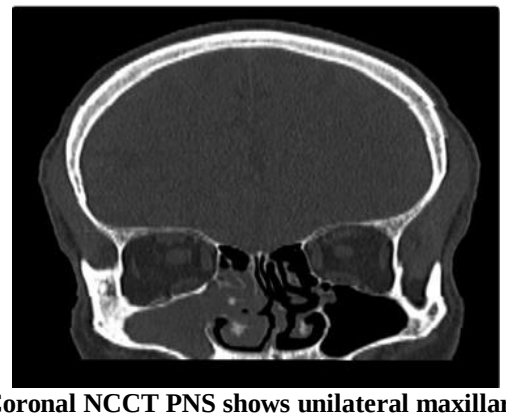
The study, involving 40 participants, revealed a significant male predominance, with 72.5% of the sample being male. This finding contrasts with previous studies by Tarim Usmani (2022) and Kushwah APS (2015), which reported varying degrees of female predominance or parity. Usmani's research highlighted females as the majority, comprising 55.4% of the patient cohort, while Kushwah APS noted a higher incidence among males with a female-to-male ratio of 1:4 (1,16). The observed male-to-female ratio of 2.05:1 in this study suggests potential gender-based disparities in the prevalence or presentation of the condition, which warrants further investigation into biological, sociocultural, or environmental factors (17).

The mean age of the participants was 39.8 years, with males averaging slightly older than females. This broad age range aligns with findings from other studies, such as those by Usmani (2022) and Kushwah APS (2015), who reported that younger age groups were more frequently affected (1,16). These age distributions underscore the complex interplay of factors influencing disease onset and progression.Nasal obstruction was the most common symptom, observed in 77.5% of the participants, followed by nasal discharge in 67.5%. The high prevalence of these symptoms highlights their significance in the clinical presentation of the condition. However, the variability in symptom prevalence compared to other studies, such as those by Usmani (2022), Kushwah APS (2015), and Srivastava (2019), suggests that symptom presentation may differ across populations and study designs (1,16,19).

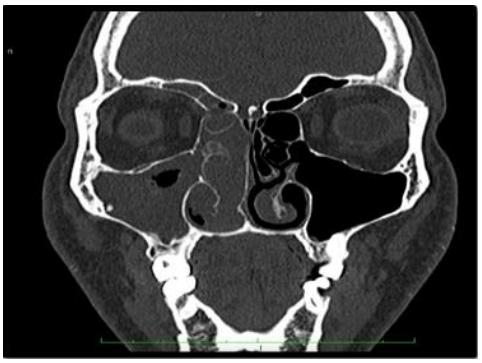
MDCT imaging revealed several important anatomical variations among the participants. Concha bullosa and Agger Nasi cells were present in 37.5% of the participants, while Onodi cells, which are crucial for surgical planning due to their proximity to the optic nerve, were found in 20% (6,19,20). These anatomical variations, which can significantly impact both the clinical course and surgical outcomes, emphasize the need for detailed imaging and careful surgical planning in managing such cases. Further research into the clinical implications of these anatomical variations is necessary to optimize patient outcomes.

CONCLUSION

This study of 40 participants highlighted a male predominance and an average age of 39.8 years, with common symptoms like nasal obstruction, discharge, and headache. MDCT scans revealed various anatomical variants and pathological features, including polypoidal masses, bony changes, and hyperdense content linked to inflammatory diseases. However, the study's reliance on imaging alone poses limitations, as MDCT may not always correlate with clinical symptoms or differentiate between conditions like fungal sinusitis and neoplasms. Expertise in image interpretation is crucial, and clinical correlation remains essential for accurate diagnosis and comprehensive CRS management.



Coronal NCCT PNS shows unilateral maxillary sinus opacification and expansion and blockage of right OMC and infundibular S/O OSTEOMEATAL COMPLEX WITH INFUNDIBULAR PATTERN OF CRS



NCCT PNS coronal section bone window showing soft tissue density in right ethmoid sinus, maxillary sinus and frontal sinus with widened maxillary

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ostium with right OMC blockage extending in right nasal cavity S/O SINONASAL POLYPOSIS

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